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## RESEARCH REPORT

THE NEED FOR A TACTICAL  
AERIAL REFUELING PLATFORM

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AIR UNIVERSITY  
UNITED STATES AIR FORCE  
MAXWELL AIR FORCE BASE, ALABAMA

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AIR WAR COLLEGE

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THE NEED FOR A TACTICAL  
AERIAL REFUELING PLATFORM

by

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A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY  
IN  
FULFILLMENT OF THE CURRICUM  
REQUIREMENT

Advisor: Colonel Robert I. Bond

MAXWELL AIR FORCE BASE, ALABAMA

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# DISCLAIMER

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## EXECUTIVE SUMMARY

TITLE: The Need for A Tactical Aerial Refueling Platform

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Remarks on historical development of and technological influences on aerial refueling introduce a discussion of current air refueling tactics followed by the author's views on how tanker assets should be developed to support a conventional war in Europe. Argued false expectations of current tanker capabilities based on successes of past air refueling operations along with a continuing dependence on emerging technological breakthrough resulted in the author questioning if production air refueling could be possible in a conventional war in Europe. The development of a tactical air refueling platform is suggested as a way to solve this potential problem. (A-1)

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### BIOGRAPHICAL SKETCH

Lieutenant Colonel Z. Douglas Cole (M.A., Webster College) has flown tanker aircraft since graduating from pilot training in 1971. He has performed duties as a copilot, aircraft commander, and instructor/evaluator pilot in the KC-135A. He has flown refueling missions virtually throughout the world and has refueled almost all types of US Air Force receivers in addition to US Navy and Marine receivers. From 1986-88, he was the commander of the 65th Strategic Refueling Squadron in Guam. This unique squadron was responsible for aerial refuelings from the International Date Line to the East African coast. He controlled KC-10s, KC-135A, and KC-135R assets. Lieutenant Colonel Cole is a graduate of the Air War College, class of 1989.

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Almost no one would argue the value of inflight refueling. Senior military planners consider the tanker force to be a "national asset . . . irreplaceable." (5:319) General officers in the US Air Force routinely make assertions such as, "an integral part of our combat planning and operations--not an option" (6:2) and "the lifeblood of our fighting force." (5:319) The same theme is also echoed in Air Force Manual 1-1, Basic Aerospace Doctrine.

AFM 1-1 defines air refueling as,

a specialized task performed by aerospace forces to support strategic, tactical, and mobility operations by extending the range, payload, and flexibility of these operations through aerial refueling. Aerial refueling has a vital role across the spectrum of employment strategies. . . . The aerial refueling force helps enhance our global power by reducing our dependence on forward basing and foreign enroute bases. Aerial refueling also extends the range, station time, mobility, and flexibility of theater forces. (2:3-6)

The first general use of aerial refueling was by the Strategic Air Command (SAC) in the early 1950s. SAC bombers required the additional fuel to accomplish their long-range missions. (6:2) As aerial refueling became more routine and the world political climate began to change, tactical forces began to recognize a need for inflight refueling. (6:2) Throughout the 1950s and early 1960s, strategic receivers accounted for a large majority of the US Air Force's air refueling missions; by 1988, however,

air refueling missions in support of tactical receivers slightly outnumbered those in support of strategic receivers. (13)

Clearly, air refueling is not considered an integral part of US combat planning and operations for both strategic and tactical forces (6:2; 2:3), but have US military planners realistically considered the capability of the current US tanker fleet to meet the tactical force challenge in all environment? As already mentioned AFM 1-1 expects air refueling to "extend the range, station time, mobility, and flexibility of theater forces." (2:6) I for one though seriously question the capability of current US tankers to perform up to those expectations in a conventional war in Europe. I would suggest that the tanker concept now being employed by the US Air Force was developed in the 1950s based on strategic needs. I believe the US Air Force over the years has taken this strategically developed asset and forced it into a tactical role.

I realize that up to now air refueling missions in support of tactical forces in conventional conflicts have met with virtually unlimited success (4:26-38); however, these past successes do not necessarily mean that the concept is correct or that it will continue to work in the future. In fact I will argue in this paper that air refueling successes in preview conflicts



especially Vietnam have led US war planners to unrealistic expectations of the current tanker fleet. In addition, I will detail how the allure of emerging technology has caused US military strategists to confuse priorities and incorrectly accept the current tanker fleet as a viable force multiplier in a conventional war in Europe.

The purpose of this paper is to suggest that the US in conjunction with some of its European allies needs to develop a Tactical Aerial Refueling Platform (TARP). I believe a tanker specifically designed for tactical operations will be much more effective in helping NATO win a conventional war in Europe than the current tanker fleet. Prior to making a specific TARP recommendation though, I feel it is necessary to set a proper framework. I will begin with an historical perspective of the current air refueling situation followed by a discussion of why I think technology is not always the panacea military planners expect. I will then attempt to gaze into the future and determine how a conventional battlefield there might look. Penultimately, I will detail why I think the current tanker fleet will be ineffective in a conventional war in Europe.

#### Historical Perspective of Aerial Refueling

Less than 20 years passed from the Wright brothers' first flight to the time when man first experimented with extending the range and flexibility of aircraft by inflight refueling. The concept, though slow developing, clearly

had potential.(7:7) Its first operational use was not until after World War II. The aggressive nature of the Soviet Union's communist party following the war convinced the US government that a deterrance was needed to hold the Soviets in check. US military planners believed that an ability to strike the Soviet homeland directly with long-range bombers using nuclear weapons would help keep the Soviets in place. In order to make these strikes, strategic bombers needed additional range. This was the needed impetus to fully develop aerial refueling techniques and a strategic aerial refueling platform. Initially converted bombers (KB-29s and KB-50s) and cargo aircraft (KC-97s) performed this mission using a variety of fuel transfer technologies. In the years that followed strategic aerial refueling progressed with the addition of a metal boom. This device allowed the boom operator to assist the large, lethargic bombers in maintaining contact with the tanker. In the mid-1950s, aerial refueling entered the jet age with the arrival of the KC-135A. (7:7,8)

By the late 1950s SAC was an avid proponent of aerial refueling and for all practical purposes, SAC's long-range bombers were the reason for the existence and growth of the tanker force. (7:7; 5:319) This attachment was so strong and seemed so natural that eventually SAC was made the single manager for all aerial refueling operations and programs. A situation that is still in existence even

unto this day. However, over a period of time it became apparent that aerial refueling held great promise and benefit for all US air forces. (7:8)

From an almost single focus in the 1950s, the tanker mission exploded into a profusion of demands and requirements. (5:320) In the mid 1960s, only about 20 percent of the US Air Force's first-line fighters were air refuelable. Today all can be air refueled. (5:320) In 1988, of the 49,292 refueling missions flown, 20,048 were for tactical or airlift aircraft. In addition more than 1100 air refueling missions were flown for the Navy and Marine Corps, whose requirements have continually grown for the past eight years. (13) Tankers are also now a fundamental part of many conventional aerial warfighting exercises such as Cope Thunder and Red Flag, and the potential for continued growth of air refueling seems almost unlimited. (5:320)

To their credit the tanker force has built a very impressive tactical mission accomplishment record over the years. From Vietnam to El Dorado Canyon, the tankers have always met the needs of the tactical forces. At the height of the Vietnam war more than 100 KC-135s were providing up to 450 air refuelings daily, greatly increasing fighter flexibility, range, responsiveness, staying power, and punch. Numerous saves of crippled and fuel-starved fighters were also credited to quick responding tankers. (5:318)

More recently the US raid on Libya proved the value of aerial refueling in today's world. In the words of Lieutenant General Kenneth L. Peek, Jr., "When the United States was unable to overfly France and Spain enroute to Libya, we were forced to take a very circuitous route. The mission wouldn't have been difficult without air refueling; it would have been impossible." (6:2)

From strategic nuclear delivery to low-intensity conflict and from strategic airlift to tactical fighter unit deployment, the tanker force has become an essential part of US Air Force plans and operations. (6:2) A quick review of official US military documents such as Air Force Manual 1-1, Air Force Issues Book, 1988 and Tactical Air Command Manual 2-1 among others indicates that the tanker role in any future conventional war or low-intensity conflict will be extensive and could in many situations prove to be vital to the success of the operations.

Due to the increased role of and reliance on aerial refueling, many improvements are being made to the tanker fleet and the tactics they use. The KC-10, KC-135R, and KC-135E models have been added to the fleet with more KC-135R and KC-135E conversions on the way. Research is continuing in the concept of adding multiple refueling points to each KC-10 so that multiple receivers can refuel simultaneously. (1:4-7) Consideration is being given to equipping KC-135s with high-flow pumps that increase the

rate of fuel offload and a new boom nozzle and load indicator system featuring improved independent disconnect features. (5:323) The KC-135s have also been recently retrofitted with tail-mounted floodlights to aid in night refuelings. (5:323)

All improvements that have been completed and all that are being considered are very worthwhile and very necessary, but it can be argued that the major problem facing growing tanker requirements is a lack of tanker aircraft. As so clearly pointed out in the 1988 Air Force Issues Book, "Real-world constraints and planning factors overtax our tanker capability in combined Single Integrated Operational Plan (nuclear) and conventional scenarios. Aerial refueling capability must be increased to address global response capability, force modernization and the ability to support an extended conflict." (1:4-6,7)

To meet this shortfall the US has set a force goal of a 1,000 KC-135A equivalents, "The Air Force measures aerial refueling in terms of KC-135A equivalents. The A model is the most numerous, oldest, and least capable of the strategic tankers. A KC-10, for instance, when used exclusively for aerial refueling, is the equivalent of up to three KC-135As" (5:319) Based on that measure, the US Air Force estimated that in 1986, the tanker fleet worked out to about 775 KC-135A equivalents; however, in a report issued in September 1985, the Congressional Budget Office

stated that with a tanker capacity of fewer than 1,000 KC-135A equivalents, "the risk would be highest of having to divert tanker resources dedicated to the strategic mission to meet conventional demand." (5:319-321)

To appreciate the dilemma of scarce tanker resources, I feel it is necessary to understand the role technology has played in the conceptual evolution of aerial refueling. It is my belief that the neverending promise of new and maybe revolutionary technology has stood in the way of TARP development.

#### Technology Trap

It may seem strange to consider technology as a possible negative. After all, technological innovation has always been one of America's abiding strengths. It has taken the US to the moon and makes wonderful promises of even more marvelous things to come. But, technology has not proven to be the panacea many envisioned. In strategic warfare technology does in fact dominate (3:3); however, in conventional warfare, technology although a major factor is by no means dominant. (3:3) Military performance is a function of many factors. In conventional warfare importance must be given to such intangibles as uncertainty, surprise, training, tactics, adaptability, national character, and the like. (3:3,4) Temporarily forgetting this has caused many large, more technologically

advanced nations to suffer black eyes and bruised egos from smaller, lesser developed countries.

Steven L. Canby, a Wilson Fellow, made the following point concerning emerging technology in NATO. "The notion that numerical inferiority in combat forces can be offset by technological superiority may be self-defeating over the long run. The empirical evidence suggests that a new technology over its life span tends to have a significant impact during its early growth period and diminishing returns during its maturing phases. Costs are stacked against the technological leader. Imitation is cheaper than innovation, and the cost of improving any aspect of technology at a steady rate increases with time. Marginal improvements in a mature technology tend to cost more and take longer than major improvements in a new technology. Thus, as both NATO and the Warsaw Pact introduce new versions of mature technology, NATO's equipment costs increase faster than Warsaw Pact's if NATO desires to maintain a constant level of technological superiority. If both sides rely on similar technologies with similar rates of improvements, the side seeking qualitative superiority can maintain it only by increasing budgetary allocations or by diverting funds from force structure to technology.

A technological solution to numerical inferiority can only be practically achieved if the technological

leader can improve the performance of his forces at costs equal to, or less than, those incurred by his opponent in attempting to catch up. Technological solutions to major force imbalances are practical only if revolutionary new technologies are periodically introduced. By contrast, technological superiority based on new versions of mature technologies will lead to cuts in force structure to help pay for marginal improvements in fielded equipment. A vicious spiral is thus initiated: Ever-better technology is needed to compensate for ever-diminishing numbers of troops and weapons. Relative combat capability suffers further as equipment becomes more complex, the supporting tail becomes larger, and training is curtailed because of operating cost. Clearly, this has been the trend of recent decades. (3:5,6)

Clearly, it is debatable as to whether or not emerging technologies can offset NATO's numerical inferiority in Europe; however, those who argue that it can admit that it will take at least a four percent real increase in defense spending each year. (3:1) A goal that most defense proponents realize goes beyond unrealistic and into the realm of ludicrous.

Another problem that arises from a preoccupation with technology is that it tends to control most of the attention of military planners and strategists. Until recently, the concept of war and military preparedness in



the US dealt almost exclusively with war against modern well-equipped forces. (9:45) It appears to me the US ignored tactical initiatives believing emerging technology alone would keep it strong: Knowing a large nuclear stockpile was available if all else failed. It also seems to me that the US assumed that if its military could deal with the Warsaw Pact then clearly it could deal with small, third world countries. However, I believe history has proven the assumption false.

Clearly technology is important, but technology can not be pursued to the exclusion of tactical application. In the Fourth Century BC, the Chinese theoretician Sun Tzu said, "In war, numbers alone confer no advantage. Do not advance relying on sheer military power." (12:122) Sun Tzu then went on to articulate some general principles of war that have since proven successful in the art and science of war: Principles that with slight modification are in this day part of US military doctrine. The specific principles of war listed in AFM 1-1 are objective, offensive, surprise, security, mass, economy of force, maneuver, timing and tempo, unity of command, simplicity, logistics, and cohesion. (2:2-4 - 2-10) These principles of war and technology are not mutually exclusive. However, I would suggest that technology should be developed to support the principles of war and not vice versa as I feel is often the case.

The principles of war are time proven truths (2:2-4) that need to be understood and implemented in the entire spectrum of conflict, whereas, technology is transitory. The allure and promise of today's great technological breakthrough is most often shattered by newer more alluring technology, the emergence of a counter technology by opposition forces, or as is often the case in the US, the budgetary ax on Capitol Hill.

To prepare to fight a successful conventional war in the future, US military planners and strategists need to free themselves from a reliance on tomorrow's technology and learn how to better apply the principles of war. Without question, all available technology should be used to enhance US warfighting capability, but care must be taken to avoid falling into the notion that technology is an answer to all problems and time spent on enhancing time proven ways of improving the mission is academic at best and fruitless at worst.

Allow me to cite a case in point. Air refueling enhances the flexibility and versatility of tactical aircraft in an area of operation. (11:5-3) This has been known for sometime; however, in my view tactical air refueling has not been adequately probed and developed. Instead, military strategists have looked for that new piece of technology that will provide tactical aircraft flexibility and versatility. To again quote Lieutenant

General Kenneth L. Peek, Jr.,

In the near term, technology will not decrease our tanker dependency. Despite the development of more fuel efficient engines and airframes, the fact remains that because of runway and operational constraints, any airplane has a maximum weight at which it can get airborne. We will always be able to extract more range or carry a heavier bomb load if we can air refuel enroute. Tactical aircraft technology has made large strides in producing efficient power plants. But to remain competitive in the combat arena, designers have had to increase thrust, practically negating increased fuel efficiency. Thus, although technology has given us some very great advances in aircraft, the fact remains we dramatically improve our combat capability through air refueling. (6:2)

#### Future Battlefield

What will the conventional battlefield of the future be like? General Robert D. Russ, a former commander of the Tactical Air Command, painted this picture for us, "We envision a fluid, non-linear battlefield in the 1990's, with the forward line of troops ebbing and flowing--a chaotic and highly lethal environment. The ability to assume certain airspace is safe or to distinguish linear battle lines will be history." (10:29-10)

In the sky over Europe, it can be argued that the US may still hold an advantage, but clearly, the US's technological edge has been slowly eroding; therefore, the question that has to be asked is what will the situation be in 15 to 20 years? Will the Soviets have better "look down, shoot down" capability? Will they have better, more lethal air-to-air missiles and stand off weapons? Will their fighters be more capable? From a ground threat

perspective the situation may be even worse. Considering the proliferation and lethality of surface-to-air missiles not only in Europe but throughout the Third World, it is apparent that in 15 to 20 the ability of an enemy force to destroy any US military aircraft will be greatly enhance.

I feel that US tactical forces realize the challenge that lies ahead of them on such a battlefield, and one way they intend to increase their chances of survivability and ultimately mission success is through the use of aerial refueling. This is spelled out clearly in TACM 2-1,

The flexibility and versatility of tactical aircraft in an area of operations are enhanced through air refueling. The area of coverage for strike and reconnaissance aircraft is greatly expanded. Ingress and egress routing to target areas can be optimized to avoid marginal weather and known defenses while permitting extended operation at low altitude where terrain-masking is available but fuel consumption is high. Increased loiter time in the target area is also provided which permits employment of ordnance at the moment it is most needed rather than at a time dictated by remaining fuel status. SAR efforts are improved by tactical aircraft capable of longer station times through air refueling. By refueling enroute to targets, tactical aircraft can carry greater ordnance loads by substituting munitions weight for fuel weight at takeoff. Air refueling also permits increased airborne alert of forces thereby increasing survivability while greatly reducing response time. (11:5-3)

All of this sounds great, but just how is the tanker force preparing to meet this need?

### Current Tankers/Future Needs

Consider current air refueling tactics. To support strategic receivers, tankers fly in multiship formations between FL 200 and FL 300. In Vietnam most aerial refuelings were accomplished in multiship formation between 10,000 feet and FL 300. In conventional warfighting exercises such as Red Flag and Cope Thunder, tankers operate in multiship formations between 5,000 feet and FL 300. Aside from airspeed the major difference between a strategic refueling and a tactical refueling is the distance between the tankers (two miles versus one mile) and the angle of the echelon (60 degrees versus 45 degrees).

I believe the lack of tactical initiative has been allowed to continue up to now simply because of the success of aerial refueling in Vietnam. It is easy to point to Vietnam and discuss the success of aerial refueling in a conventional environment, but I maintain this would be a very misleading application of past history. The US owned the skies over the areas of Vietnam where tankers operated and air refueling took place, and luckily that airspace was conveniently located between the fighter bases and the targets in the North. Even with this favorable situation most strike and fighter aircraft could loiter in the target area for only about 15 to 20 minutes if they did

not use afterburner, and most required additional air refueling enroute home. (4:26-38)

A quick look at Europe shows just how this piece of history has colored some assumption about a future war between NATO and the USSR. In Europe most tactical aircraft are refueled in selected airspace over Germany and Belgium. Apparently, military planners assume that in the event of hostilities this airspace would still be safe for air refuelings; however, I doubt that tankers as they now operate could refuel on any type of consistent basis in those areas. I believe Warsaw Pact aircraft would be too numerous and too lethal. I do not think tankers would venture any further east than the English Channel.

Recently, a general officer speaking at the Air War College suggested that all NATO airfields in Europe would be lost within 48 to 72 hours after the onset of hostilities. If this occurred all tactical aircraft would have to operate in Great Britain, a great distance from the battlefield. Either way, from Great Britain or Central Europe, the closer the tankers get to the battlefield the more flexibility and versatility tactical aircraft will have. Currently, I have grave doubt about the tankers getting close enough to even make it worthwhile for tactical forces to refuel. If fighters stationed in Germany have to fly to the English Channel for fuel, will it be worthwhile?

Considering the US doctrine of force packaging and Follow On Forces Attack the question has to be asked: Do US tactical fighters have the capability to takeoff, join up, penetrate enemy defenses, attack the target, and return home without aerial refueling? I would think the answer would be no in many situations. If the answer is yes, it would seem the yes would have to be caveated with the warning that flexibility, maneuverability, and staying power would all be reduced.

So what is being done to enhance air refueling capabilities in support of tactical forces in a conventional war in Europe? US military planners have approached the problem from a stand point of total number of tankers and have ignored what I consider to be the more important issues of location and availability. It seems that the US Congress has decided that a 1,000 KC-135A equivalent force would solve the US military's refueling problems, but what is the significance of a 1,000 KC-135A equivalent force? From a strategic point of view, the solution may be valid. It is strictly a numbers game. Strategic refueling is accomplished in non-hostile airspace enroute to the target. However, from a tactical perspective, the whole concept of bean counting is bankrupt and extremely dangerous. If the tanker does not have the capacity to operate where it is needed in a future

conventional war, it really doesn't matter how many booms are available.

I would suggest that the real conventional air refueling issues are location and availability. If tankers could be positioned very near to the battlefield, conventional operation would be greatly enhanced. I believe this is possible through the development of a TARP.

#### Tactical Air Refueling Platform

The US needs to fully develop a TARP from the ground floor up, preferably using emerging vertical/short take-off and landing and stealth technology. However, since the wish list of current military needs is so long and the defense budget is so tight, I do not see that as a viable option at this time. Planning for the future, though, should begin here.

For the time being the following modifications should be made to the current tankers to make them more capable in a tactical role, or in other words, to make them both strategic tankers and TARPs.

1. All tankers should be equipped with a multi-point air refueling system. This would greatly enhance the speed in which tactical forces could be refueled; a major factor in a conventional environment.

2. All tankers should be equipped so that they have the option in flight to use either boom or hose-drogue refueling. KC-10s have the capability now. The rest of the



force needs it. By FY 90, 51 percent of all USAF, Navy, NATO, and allied receiver aircraft will be probe-equipped. (1:4-7) Having this option will provide much greater flexibility to commanders in conventional joint and combined operations.

3. All tankers need to be able to receive fuel inflight as well as offload. Here again the KC-10 and some few KC-135s have this capability. The rest of the tanker fleet desperately needs it. It opens up almost unlimited options in any conventional situation.

4. The tanker fleet needs to be able to perform its mission at lower altitudes; at least down to 1,000 feet above ground level, and maybe even lower. Therefore, whatever structural modifications are required need to be accomplished so that low-level refueling can be done on a routine basis. Low-level refuelings greatly enhance the chances of mission completion and mission success for tactical aircraft.

5. The tanker fleet needs to be equipped with, at the very minimum, some type of defensive avionics systems. In addition some serious thought should also be given to also including an offensive avionics system.

In order to make tactical air refueling meaningful all of the above modifications need to be done. Now, I know that here most planners' thoughts are turning once again to the tight budget, but many of the US's European

allies have just as much to gain from the development of a TARP as does the US. (5:323) I believe a joint venture into this area is viable and would, in the end, cost the US only a pittance compared to the additional combat capability gained.

### Conclusion

The growing role of aerial refueling and the certainty of the need for aerial refueling by tactical air forces in any future conflict begs that the following question be asked. Is the tanker force up to the tactical challenge of the next conventional war? It might be said that they met the tactical challenge in the past. They have proven their conventional capability in combat. Well, that may be true of the past, but it would be very foolish to assume past victories guarantee future successes.

A close examination of the progress and innovation in the tanker force over the years will reveal that little of substance has been done to help the tanker operate closer to the conventional battlefield or enhance a tactical operation. The reason for this is very simple but two-fold. First, as already mentioned, most planners erroneously assume that because the tankers have always been successful, they will continue to be successful in the future. It can be argued though that US aerial refueling has always been able to operate in a non-hostile environment. Tankers have never had to penetrate hostile

airspace and face enemy fighters or overfly surface-to-air missiles or anti-aircraft artillery sites. The US should seriously consider that this may be the case in the future. Secondly, since the end of World War II, the US has countered most military threats with the concept of technological superiority. In Europe, the fall back position has been the use of nuclear weapons. Because of this dependence on technology, tactics suffered and priorities became confused. The seductive lure of technology subconsciously mesmerized military and political planners into viewing the promises of technology as the answer to all their problems.

Therefore, I have grave doubts about the ability of the current air refueling fleet to make any meaningful contributions to a conventional war in Europe. Current air refueling concepts were grounded in the strategic environment of the 1950s and have remained stagnant ever since. Pinning hopes on emerging technology may work if the emerging technology (1) works as advertised, (2) is not neutralized by the enemy's newer technology, and (3) is funded by Congress and available to the troops. However, in the face of all the uncertainty, it would seem logical to develop an idea that would provide the margin of victory without having to rely on tomorrow's technology.

I would suggest that building tactical aerial refueling platforms is one step in the right direction.

The use of TARPs would greatly increase the flexibility and versatility of all tactical air operations in a conventional war.

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